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Auditory speech-discrimination as a function of age and type of audiogram

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AUDITORY SPEECH-DISCRIMINATION AS A FUNCTION OF AGE AND TYPE OF AUDIOGRAM

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AUDITORY SPEECH-DISCRIMINATION AS A FUNCTION OF AGE AND TYPE OF AUDIOGRAM

Previous studies have shown that sensitivity for pure-tones becomes poorer with age, with greatest decrement occurring after age 60 (Bunch (2), Wisconsin Hearing Survey (7), United States Public Health Service Survey (8). Other studies have reported poorer discrimination for older subjects (age range 60 to 90 years) than for younger subjects (age range 20 to 59 years). Pestalozza and Shore (6) found that discrimination for PB words in young people (not more than 40 years of age) was always 9-20% better than that of older people (60-90 years of age) with the same amount of pure-tone hearing loss. The amount of hearing loss was determined by averaging the frequencies 500-2000 Hz. Goetzinger et al. (5), using the W-22 test and the Rush Hughes recording of the PB word list, showed that auditory discrimination scores became worse by 5-10% per decade for patients over 60 years of age. Feldman and Regar (4) found a decrease in the discrimination scores of subjects above age 50 for the W-22 PB word list, with the scores becoming worse by about 5% per decade for patients over 50 years of age. Berkowitz and Hochberg (1) studied discrimination ability in 100 subjects between 60-87 years of age using the first 25 words of list 1D of the CID W-22 auditory test. Their results showed that discrimination scores became worse by 6-10% per decade over 60 years of age.

The present study is concerned with discrimination as a function of age and the type of audiogram. It is designed to show if loss for discrimination with increasing age is found in patients with audiograms showing steep high-frequency losses.

Procedure

The subjects for this study were selected from approximately 1500 cases in the files of the Audiology Laboratory at McMillan Hospital (Barnes Hospital, St. Louis, Mo.). In order to reduce the time involved in locating the necessary audiometric data, a card index was used that contained the names of patients with sensorineural hearing losses seen at the Laboratory between 1969-1971. All of the cases selected demonstrated sensorineural hearing impairments and their audiograms showed less than a 10 dB difference between air- and bone-conduction thresholds. Frequently, bone-conduction data had not been obtained for patients who had normal hearing throughout the speech frequencies but dropped at 4000 and/or 8000 Hz. In these cases, the subject was accepted if no history of middle ear infections was present. Speech discrimination was tested with the Rush Hughes PB-50 lists at a 40 dB Sensation Level. Either List 9B or 10B was employed in all cases except for seven cases in which the list was not specified.

The following information was also recorded for each case: (1) length of time of hearing aid use, if any; (2) etiology; (3) Speech Reception Thresholds; (4) sex; and (5) name of the tester. All of the testing was done on Maico 24 audiometers. Seven decade age ranges from

10-79 years were included. The types of audiograms that were compared are described below:

(1) Between 0-20 dB Hearing Level through 500 Hz, with at least a 20 dB drop at 1000 Hz (Type I).

(2) Between 0-20 dB Hearing Level through 1000 Hz, with at least a 20 dB drop at 2000 Hz (Type II).

(3) Between 0-20 dB Hearing Level through 2000 Hz, with at least a 20 dB drop at 4000 Hz (Type III).

(4) Between 0-20 dB Hearing Level through 4000 Hz, with at least a 20 dB drop at 8000 Hz (Type IV).

A further criterion for inclusion was that the frequencies higher than the cut-off frequency could not improve more than 10 dB from the specified cut-off frequency and also could not be better than 20 dB Hearing Level. It was intended that 10 audiograms for each age range at each frequency cut-off would be found.

Results and Discussion

It was not possible to completely fill all age groups for each type of audiogram in the time allowed for this study. A total of 151 appropriate cases were found, however. A record of hearing aid use was available in only three of these cases and the length of time of use was not specified. The etiology was recorded only if the diagnosis had been made by a medical doctor. The etiologies of the cases selected included one case of Meniere's disease and the remaining 150 cases were classified as "unknown."

The Speech-Reception Threshold's that were obtained are shown

in Table 1. It appears that the SRT's within each audiogram type worsen with age by 3-20 dB. However, when the two-frquency and three-frequency averages for the older patients were compared with their SRT's they generally showed good agreement. The two-frequency pure-tone average was included because it is more accurate in predicting the SRT for audiograms such as Type II which drops sharply at 2000 Hz.

The frequency distribution of males and females for each age range and audiogram type (Table 2) shows that at least three times as many males as females were found in the files with audiogram Types I, II, or III, although efforts were made to select an equal number of cases of each sex. In the cases of audiogram Type IV, only 5 out of 17 cases were male.

Mean discrimination scores as a function of age for each type of audiogram are shown in Figure 1. Discrimination scores obtained for all cases are shown in Table 3. Only for Types II and III was it felt that sufficient data were obtained to allow a comparison to be made between discrimination scores for younger and older patients and between audiogram types.

Both Types II and III clearly show a drop in discrimination score with age. It was felt that this result reflects what Gaeth (7) described as "phonemic regression." This is a term applied to patients who show a greater discrimination loss for speech than would be predicted by the pure-tone average. Pestalozza and Shore (6) also offered phonemic regression as an explanation of the results in their

study in which discrimination in young people was always from 9-20% better than that of the old people with the same amount of hearing loss.

Each age group's mean discrimination score was worse for Type II than for Type III. The discrimination score for the 20-29 year old group for Type II was 76% and for Type III, 82%. For the 70-79 year old group the mean discrimination score for Type II was 64% and for Type III, 75%. Data collected for Types I and IV are too incomplete to make a comparison between audiogram types.

It is suggested that additional data be collected to obtain more conclusive results.

Since the results of the present study indicate a decline in discrimination ability with age, this may suggest the need for training in speechreading and auditory training. A study by Farrimond, (3), using 100 male subjects between the ages of 20-74 years, showed that the ability to make use of visual cues to understand speech seems to diminish after the age of about 39 years, and scores obtained by the subjects over 60 fall to approximately half of those made by the 30-39 year old subjects.

When counseling young patients with the types of hearing losses described in the present study it might be advisable to consider the results of Farrimond's study and the present study. An 18 year old with a Type II audiogram could be advised that he may have more difficulty understanding speech as he becomes older and that he should consider taking a few speechreading lessons while he is young. Of course, it is

realized that the threat of future difficulty may not provide sufficient motivation for a young patient and the suggestion may be ignored. However, since such a suggestion cannot be harmful to the patient, it is recommended that in counseling, consideration should be given to the possibility of decreasing ability to understand speech and to use visual cues with advancing age.

TABLE 1

SPEECH-RECEPTION THRESHOLDS
BY AGE RANGE AND AUDIOGRAM TYPE

	Age Range						
	10-19	20-29	30-39	40-49	50-59	60-69	70-79
Type I							
Patient							
1	39	18	24	23	46	38	42
2		20		28	27	35	36
3					48	50	40
4					38	40	
5						36	
6						24	
7						35	
8							
9							
10							
Mean	(39)*	19	(24)	25.5	39.8	36.9	39.3
Type II							
1	4	4	10	18	18	16	18
2	8	10	10	15	17	22	20
3		12	5	0	20	12	17
4			2	10	24	10	15
5			10	14	24	10	10
6			12	16	18	3	8
7			8	15	25	8	22
8					14	15	12
9					13	7	
10					5	25	
	6	8.7	8.1	12.6	17.8	12.8	15.3

*( ) indicates data based on only one patient in age-type category.

TABLE 1--Continued

	Age Range						
	10-19	20-29	30-39	40-49	50-59	60-69	70-79
Type III							
Patient							
1	0	0	6	8	6	12	18
2	13	10	2	18	10	10	8
3	1	12	8	4	8	15	4
4	4	0	4	10	12	10	13
5	14	0	8	8	12	10	8
6	0	4	0	4	10	4	12
7	1	2	8	4	7	6	5
8	10	16	6	18	13	20	2
9	2	7	10	0	5		
10	10	17	12	11	0		
Mean	5.5	6.8	6.4	8.5	8.3	10.9	8.8
Type IV							
1	3	10	0	10	0	10	10
2	5		2	5	12	8	10
3	1				6	6	
4						6	
5							
6							
7							
8							
9							
10							
Mean	3	(10)*	1	7.5	6	7.5	10

*() indicates data based on only one patient in age-type category

TABLE 2

FREQUENCY DISTRIBUTION OF MALES AND FEMALES
BY AGE RANGE AND AUDIOGRAM TYPE

Age Range	Type I	Type II	Type III	Type IV
		Males		
10-19	1	2	8	3
20-29	1	3	7	
30-39		5	9	1
40-49	2	6	7	
50-59	4	7	7	
60-69	5	9	6	1
70-79	3	4	5	
		Females		
10-19			1	
20-29	1		2	1
30-39	1	2	1	1
40-49		1	2	2
50-59		3	2	3
60-69	3	1	1	3
70-79		4	3	2

TABLE 3

DISCRIMINATION SCORES
BY AGE RANGE AND AUDIOGRAM TYPE

	Age Range						
	10-19	20-29	30-39	40-49	50-59	60-69	70-79
Type I							
Patient							
1	48	46	76	58	32	56	10
2		50		54	40	52	46
3					30	62	30
4					54	68	
5						62	
6							
7							
8							
9							
10							
Mean	(48)*	48	(76)	56	39	50.	28.7
Type II							
1	82	76	76	62	66	68	52
2	84	78	76	60	68	72	66
3		74	80	80	66	70	52
4			80	70	60	52	70
5			80	78	72	68	72
6			60	56	72	64	64
7			72	52	64	68	60
8					80	58	74
9					88	68	
10					60	60	
Mean	82	76	74.2	65.4	69.6	64.8	63.8

*( ) indicates data based on only one patient in age-type category.

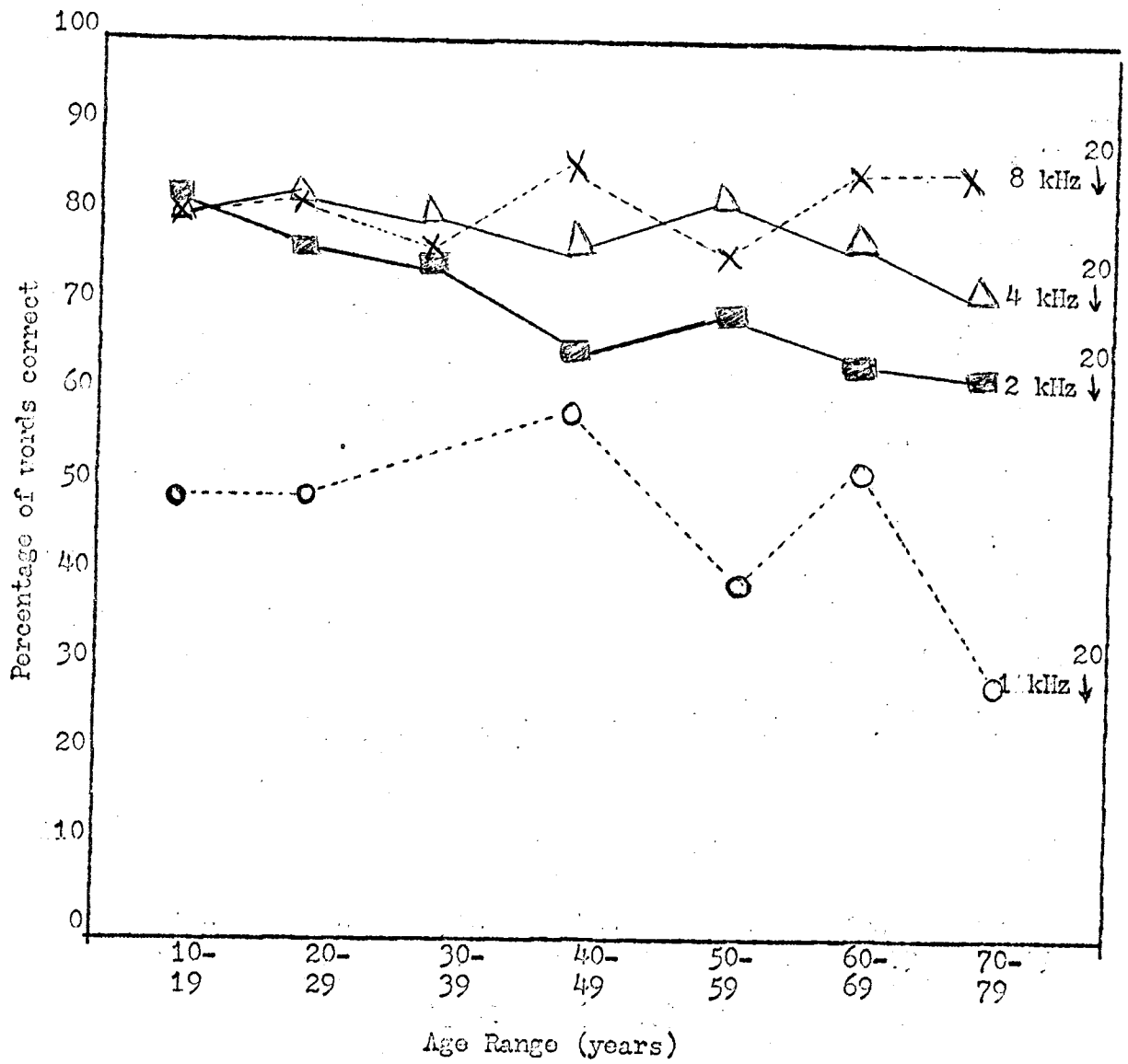
TABLE 3--Continued

	Age Range						
	10-19	20-29	30-39	40-49	50-59	60-69	70-79
	Type III						
Patient							
1	74	72	76	80	96	92	72
2	72	80	84	80	88	80	64
3	84	80	64	80	80	76	76
4	88	84	84	80	72	80	76
5	64	80	84	70	84	76	66
6	80	84	84	64	68	76	84
7	80	92	84	80	84	70	84
8	92	76	84	80	88	80	76
9	84	80	72	88	80		
10	88	88	88	92	92		
Mean	80.6	80.4	80.4	79.4	83.2	78.7	74.7
	Type IV						
1	80	80	88	84	72	88	88
2	88		64	88	76	84	80
3	72				88	84	
4						80	
5							
6							
7							
8							
9							
10							
Mean	80	(80)*	76	86	78.7	84	84

* ( ) indicates data based on only one patient in age-type category

FIGURE 1

MEAN DISCRIMINATION SCORES AS A FUNCTION OF AGE AND TYPE OF AUDIOGRAM



Note:

Dotted lines indicate that insufficient data were available.

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